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DRAWINGS ATTACHED

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## (54) FOLDING MECHANISMS FOR ROTARY PRINTING PRESSES


(71) We, SCHNELLPRESSENFABRIK KOENIG & BAUER AKTIENGESELLSCHAFT, 87 Wurzburg 7, Germany, a German Company, do hereby declare

the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to folding mechanisms for rotary printing presses for the production of especially thick newspapers.

Folding mechanisms have so far been built as 2:1 or 3:2 gear folders the maximum page capacity of which amounts to 112 up to 128 pages. It is a disadvantage that the speed of the rotary printing presses has to be reduced because it is difficult to cut and fold products of such a thickness. A 128-page product requires eight paper webs which, after having been folded on formers, form altogether a ribbon of thirty-two papers. When cutting these thirty-two papers which have a total thickness of about $\frac{1}{8}$", the cutting blades are subject to considerable wear. When running collected with 2:1 folders, the alternate portions of the thirty-two paper ribbon forming the outer section of the collected products must be guided around a small cylinder of about half-plate cylinder size which runs at a high speed and thus exerts high centrifugal forces. This is why even a 112-page production presents great difficulties. In 3:2 folders the alternate portions of the thirty-two paper ribbon for the outer section of the collected products are fed below the portions of the thirty-two paper ribbon for the inner section of the collected products and thus rhythmically enlarge the 3:2 cylinder by about $\frac{1}{8}$". This however amounts to more than 10% of the radius. This involves, therefore, heavily fluctuating conditions of traction which lead to a tearing-up of the pinholds and a lift-off of the pages, and other difficulties. In all folders for thick products the inner paper ribbons do not run well into the folding cylinder group because they are too loose. They are pushed back by the outer paper ribbons which are stretched too tight. Owing to these difficulties in folding which prove to be highly disadvantageous, the printing presses for the production of thick newspapers have to be limited in speed and consequently in their output.

It is among the objects of the invention to provide a folding mechanism operating to avoid these disadvantages and to fold laminated products without having to limit press output.

According to the invention, there is provided a folding mechanism for a rotary printing press in which a continuous printed web is longitudinally split into two halves, the mechanism comprising two pairs of cutting cylinders respectively provided for laterally cutting the two halves of the printed web, a collecting cylinder arranged to receive laterally cut sheets from the two pairs of cutting cylinders, two rotary folding blade cylinders, and a pair of folding rollers associated with each folding blade cylinder, at least one of said folding blade cylinders being arranged to be rotatable at a lower circumferential speed then the collecting cylinder and operable to receive products secured to alternate sections on the collecting cylinder for cross folding sheets transferred from the collecting cylinder during collected and straight run operation, one of the rotary folding blade cylinders being provided with rotary folding blades which only project from the periphery of the rotary folding blade cylinder at one point, between the folding rollers, during each revolution.

With this construction, it is possible to arrange one of the rotary folding blade cylinders so as to be rotatable at the same circumferential speed as the collecting cylinder during straight run operation.

Advantageously the collecting cylinder has a 5/2 circumference, that is to say it can accommodate five newspaper sections and deliver them to two folding blade cylinders

which are disposed on the collecting cylinder at an angular spacing of 120°.

A 160-page thick newspaper requires, for example, ten paper webs, five of which run for expediency's sake, over two upper formers and five of which over two lower formers. This amount can still be easily handled by each former. The longitudinally folded webs coming from two formers, that is to say two twenty paper ribbons, are each fed to a separate pair of cutting cylinders. The cutting of twenty papers does not present any difficulties. Both pairs of cutting cylinders transfer the sections to the 5:2 collecting cylinder. This results in one hundred and sixty pages when running collected in 2 × 80 pages when running straight.

In the further development of the invention one transfer cylinder is provided in front of each folding blade cylinder. This transfer cylinder will then always produce a gap of 1 product length.

The folding blade cylinder disposed behind one of these transfer cylinders then runs at a reduced speed, for example at half speed and seizes the product by means of grippers in order to facilitate a speed jump of the product into low-speed operation. Such a folder with slowed down cross fold is suitable for folding products of one hundred and sixty pages or more, which hitherto were unacceptably thick, at maximum speed.

Furthermore, it is also possible to use each of the two cutting cylinder groups for collected run by choosing, for example, the ratio 3:2 for the male and female cutting cylinders.

Of the two folding blade cylinders the blades of one cylinder can carry out the standard, known folding blade motion, for example the three-point hypocycloid. With the second cylinder the product runs almost completely around the cylinder so that the folding blades of this second cylinder must be controlled in such a way that they only project beyond the periphery of the cylinder at one point, between the folding rollers during each revolution. In this case the known 3:2 gear folder system may be used, provided with a 3:2 cylindrical surface on the 3:2 cylinder rotating eccentrically around the knife bar, or the blade tips are position-controlled by gear means as described in Patent Specification No. 1,256,431. An embodiment of the invention is hereinafter described in detail by way of example with reference to the accompanying drawings in which

Figure 1 shows a folding mechanism with two pairs of cutting cylinders, collecting means which operate without retardation and on which are mounted two folding blade cylinders which are angularly spaced by 120°;

Figure 2 shows a folding mechanism with two pairs of cutting cylinders provided for collected run which deliver the products to a collecting and transfer cylinder. The products are folded off by two folding blade cylinders the first of which operates without retardation, and the second of which operates with or without retardation;

Figure 3 shows a folding mechanism with two pairs of cutting cylinders in which, during straight-run production, the products are delivered alternately to transfer cylinders of 4/2 circumference which are provided on the 5/2 collecting cylinder at a 120° stagger. The products are folded off by two folding blade cylinders which run slower than the transfer cylinders: In collected-run production one transfer cylinder and the associated folding blade cylinder will be silenced;

Figure 4 shows a lateral view of a rotary printing press consisting of 10 printing units. Coming from five units each the paper webs run to two formers each positioned side by side; and

Figure 5 shows the arrangement of the formers of the rotary printing press according to Figure 4.

According to Figure 1, paper webs 201, 202 are cut by two 2/2 male cutting cylinders 203, 204 working against two 2/2 female cutting cylinders 205, 206 and the products are collected on a 5/2 collecting cylinder 207. However, on this cylinder are provided two 4/2 folding blade cylinders at a distance of 120° which tuck the product between the folding rollers 210, 211 and 212, 213 respectively. The folding blade cylinders 208, 209 are equipped with 2 folding blades each. The folding blades of the folding blade cylinder 209 are controlled in such a way that they only project beyond the periphery of the cylinder 209 when dipping between the folding rollers 210, 211.

In collected run either one of folding blade cylinders for example 208, is inoperative or the picker pins of the folding blade cylinder 208 are inoperative so that it cannot take up any products, the cylinder 209 being arranged to be rotatable at a lower circumferential speed than the collecting cylinder 207.

Figure 2 shows a folder incorporating two folding blade cylinders 258, 259 on the collecting cylinder 257. In this case the paper webs 251, 252 are cut by the 2/2 cutting cylinders 253, 254. The products can be transferred directly (double production) to one 4/2 collecting cylinder 257 by the 3/2 female cutting cylinders 255, 256 or can primarily also be collected on them. In double production both folding blade cylinders 258, 259 operate, whereby the folding blade cylinder 258 receives and folds off each second product from the collecting cylinder 257. In collected run there is no product intended for the folding blade cylinder 258. Since in collected run a free section follows

after each occupied section on the collecting cylinder 257, the folding blade cylinder 259 is arranged to be rotatable at a lower circumferential speed than the collecting cylinder 257 without causing any distortion of the product because the product is able to slide onto the unoccupied section of the surface of the collecting cylinder 257 during retardation. The double-thick collected product can therefore be folded by means of folding blade cylinders which rotate with much lower circumferential speed than the collecting cylinder. However, in straight-run production there are also unoccupied sections adjacent folding blade cylinder 259 since, then, the folding blade cylinder 258 folds off every second product. Therefore, it is possible to rotate the folding blade cylinder 259 with a lower circumferential speed than the collecting cylinder 257, if the other folding blade cylinder 258 is rotated with the same circumferential speed as the collecting cylinder 257, because in straight-run operation the products arrive without interruption at the folding blade cylinder 258. The folding blades of the cylinder 259 only project from the periphery of the cylinder at one point, between the folding rollers, during each revolution.

In order to allow this rotation to both folding blade cylinders with lower circumferential speeds than the collecting cylinder in double production, the folding mechanism according to Figure 3 is provided with 4/2 transfer cylinders 308, 309 between a 5/2 collecting cylinder 307 and two 3/2 folding blade cylinders 310, 311 with two rotating folding blades each. By means of two 2/2 male cutting cylinders 303, 304 the paper webs 301, 302 are cut into sheets which are transferred to the 5/2 collecting cylinder 307 by the 2/2 female cutting cylinders 305, 306. The 4/2 transfer cylinder 308 receives every second product from the collecting cylinder 307 so that only every second section of the transfer cylinder 308 is occupied. For this reason the folding blade cylinder 310 can run at half the circumferential speed of the collecting cylinder 308. When being seized by the grippers 312 of the folding blade cylinder 310, the product, which is retarded by the folding blade cylinder, can slip onto the unoccupied circumference of the transfer cylinder 308 without suffering any distortion, because the following section of this cylinder 308 is free. This distortion-free operation is also possible for the cylinders 309 and 311.

The hypocycloid described by the folding blades of the cylinder 310 must be modified so that the folding blades only project from the periphery of the rotary folding blade cylinder at one point, between the folding rollers 313, 314, during each revolution.

In double production, that is to say when both folding blade cylinders 310 and 311 are operating, the products are delivered by the delivery fans 315, 316 onto two oppositely directed conveyor tapes 317, 318 respectively disposed below two pairs of contrarotatable fans for co-operation with one of the fans of each pair.

The advantages of a double delivery (split delivery) can, however, only be utilised in collected-run production by installing an intermediate transfer path 319 which connects the conveyor tapes 317 and 318. For obtaining the split-delivery effect one of the fans 320, 321 of each pair, which is otherwise inoperative, is put into operation. Consequently, if the folding blade cylinder 310 is shut down, a deilvery fan 320 is provided beside the delivery fan 315. One half of the number of the paddles is removed from the delivery fan 315 and mounted on the hub of the delivery fan 320 so that every second product can be delivered onto the transfer path 319 which forwards them to the conveyor tape 318. When shutting down the folding blade cylinder 311, the corresponding procedure to be followed is to install a delivery fan 321.

A printing press, by means of which newspapers of such a thickness can be produced, is shown in Figure 4. The folding mechanism 351 is provided in the middle of the press. At the right and left of the folder there are five printing units 352 and the paper webs 353 for these units unwind from the reel stars 354. Five paper webs 353 each are associated above the formers 355, 356 and 357, 358 respectively. After having made the longitudinal slit and the longitudinal fold the paper webs, as previously described, are led over hte cutters and folded.

An example of such a web lead is shown in Figure 5. The paper webs coming from the right press section are led over the formers 357, 358. Below these are provided the formers 355, 356 by means of which the paper webs coming from the left press section are longitudinally folded.

The paper webs coming from the right and left press section are associated by the web-guiding rollers 359. The associated paper ribbons 360 are fed to a first cutting cylinder group, and the ribbons 361 to the second cutting cylinder group of the folding mechanisms described.

According to the examples specified, the required, extremely thick newspapers can be subsequently folded.

WHAT WE CLAIM IS:—

1. A folding mechanism for a rotary printing press in which a continuous printed web is longitudinally split into two halves, the mechanism comprising two pairs of cutting cylinders respectively provided for laterally cutting the two halves of the printed web, a collecting cylinder arranged to receive laterally cut sheets from the two pairs of

cutting cylinders, two rotary folding blade cylinders, and a pair of folding rollers associated with each folding blade cylinder, at least one of said folding blade cylinders being arranged to be rotatable at a lower circumferential speed than the collecting cylinder and operable to receive products secured to alternate sections on the collecting cylinder for cross folding sheets transferred from the collecting cylinder during collected and straight run operation, one of the rotary folding blade cylinders being provided with rotary folding blades which only project from the periphery of the rotary folding blade cylinder at one point, between the folding rollers, during each revolution.

2. A folding mechanism according to Claim 1, in which one of the rotary folding blade cylinder during straight run operation. same circumferential speed as the collecting cylinder ruring straight run operation.

3. A folding mechanism according to Claim 1, in which a transfer cylinder is disposed between each folding blade cylinder and the collecting cylinder.

4. A folding mechanism according to Claim 1 or Claim 3, in which two pairs of contra-rotatable fans are respectively mounted below the two rotary folding blade cylinders and two oppositely directed conveyors are respectively disposed below the two pairs of fans for co-operation with one of the fans of each pair, and an intermediate conveyor extending between the two conveyors for selective co-operation with the other fan of each pair of fans.

5. A folding mechanism, substantially as hereinbefore described and illustrated in the accompanying drawings.

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1304097 COMPLETE SPECIFICATION
5 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

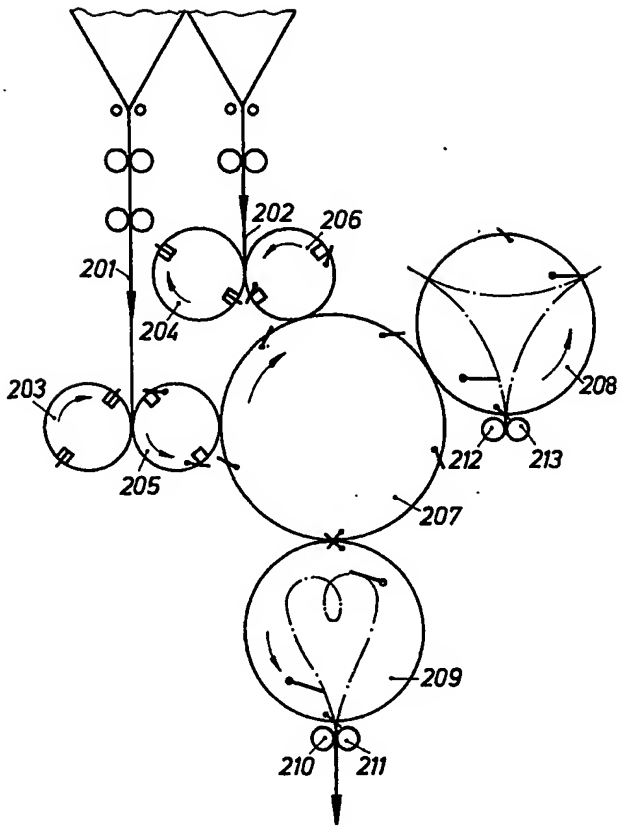


*Fig. 1*

1304097 COMPLETE SPECIFICATION
5 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
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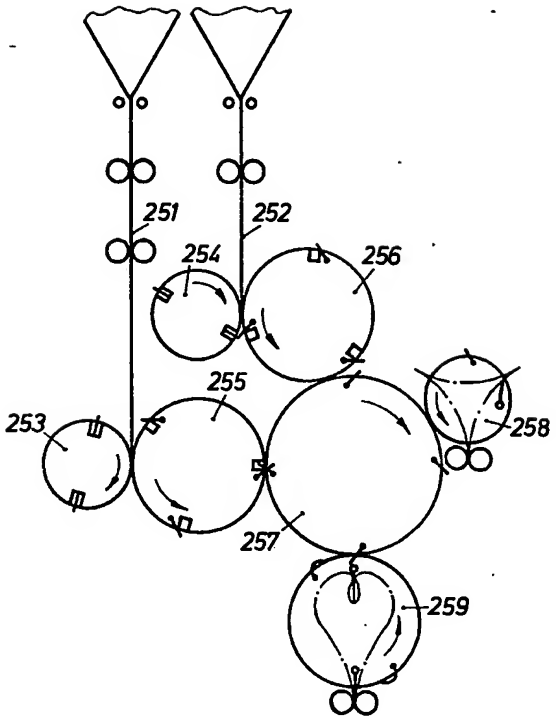


*Fig. 2*

1304097 COMPLETE SPECIFICATION
5 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
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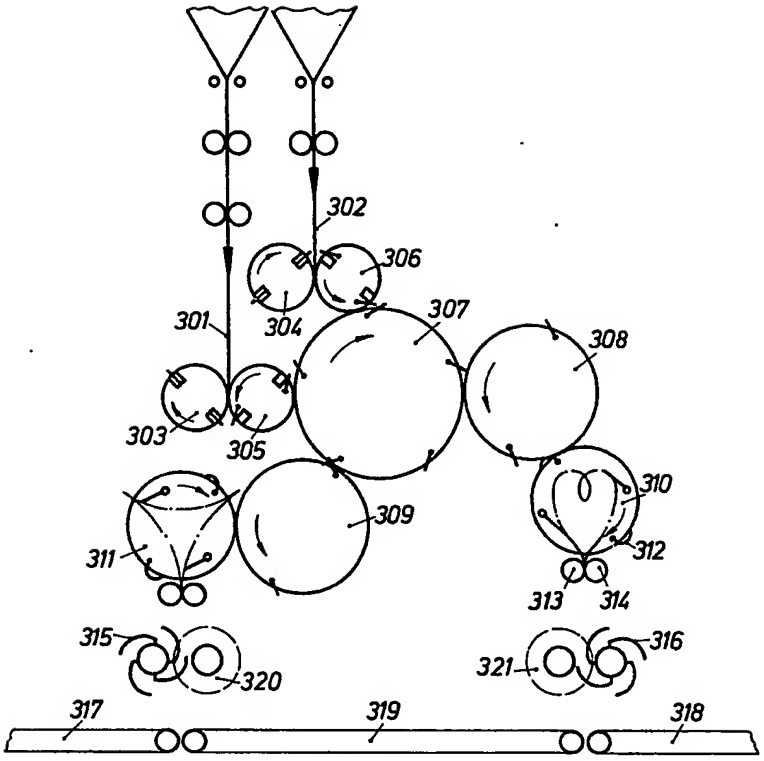


*Fig. 3*

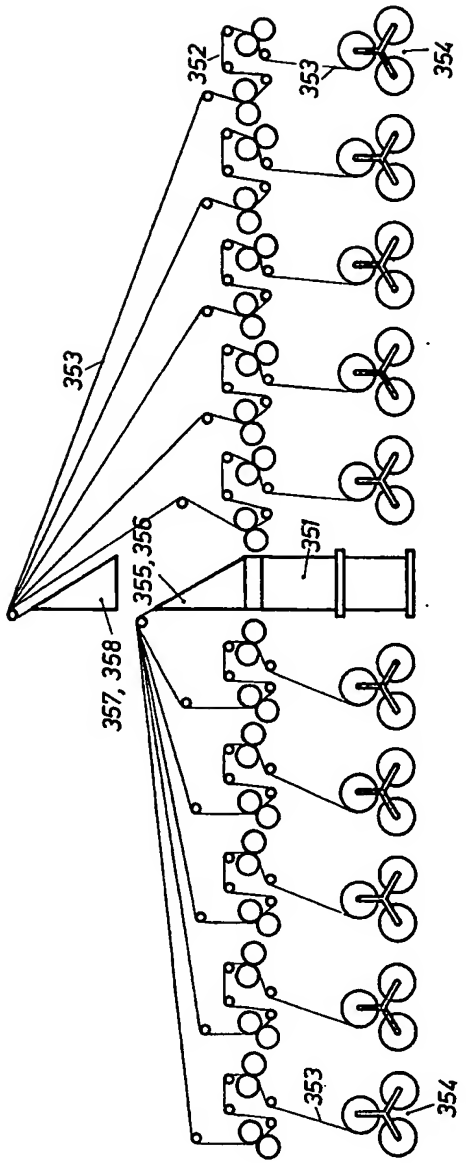


Fig. 4

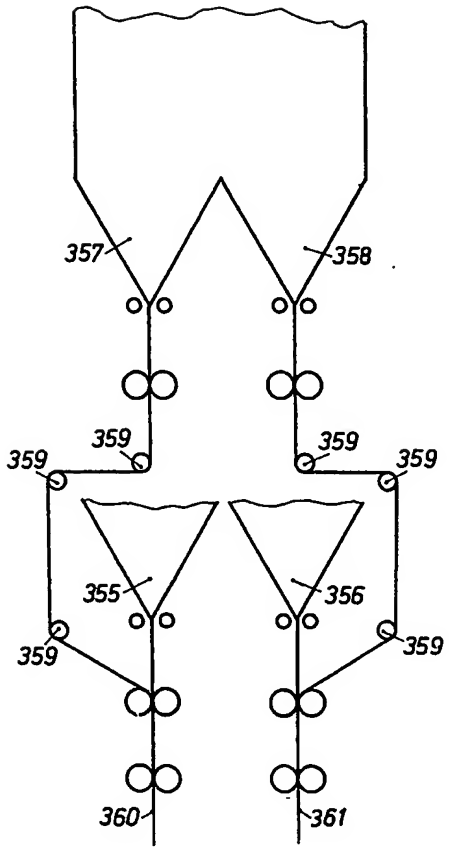


*Fig. 5*